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New York Agricultural Experiment Station.

GENEVA, N. Y.

DIRECTOR'S REPORT FOR 1898.

W. H. JORDAN.

PUBLISHED BY THE STATION.

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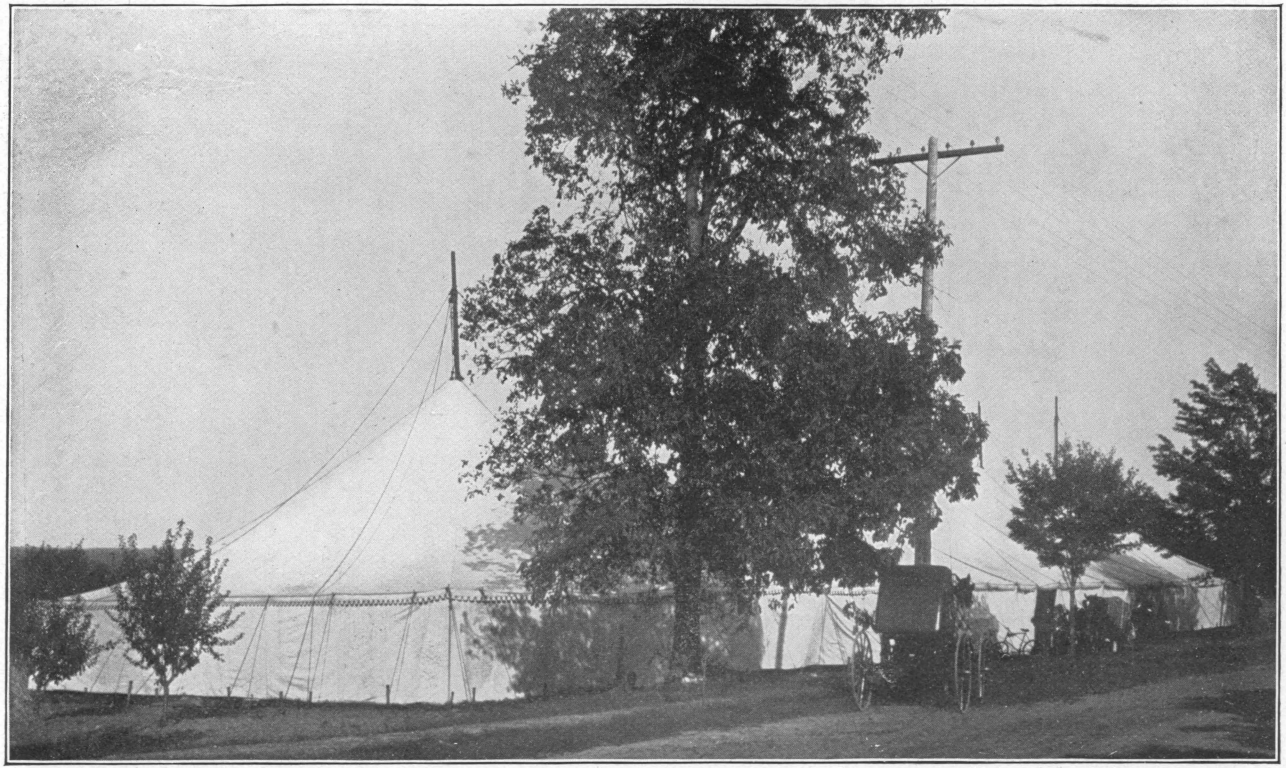
BIOLOGICAL AND DAIRY BUILDING.



TENT USED FOR DEDICATION EXERCISES.

BULLETIN No. 153.

DIRECTOR'S REPORT.

To the Honorable Board of Control of the New York Agricultural Experiment Station:

Gentlemen:—I have the honor to present herewith the report of the New York Agricultural Experiment Station for 1898.

The past year has been characterized especially by the completion of plans which for some time you have had under consideration and development.

Notable additions have been made to the building and apparatus equipment; the scientific staff has been enlarged, and the scope and efficiency of the Station facilities for studying problems important to agricultural practice have been much increased thereby.

It is very gratifying to be able to report, also, that all this has been accomplished, at the same time that the usual activities of the Station have been fully maintained, with the most harmonious thought and action on the part of all concerned. Neither internally nor externally has the work of the Station suffered from dissensions or unpleasant criticism, a condition of things for which your director desires to make profound acknowledgment.

THE STATION STAFF.

In my report for 1897, mention was made of the election of Mr. H. A. Harding as Dairy Bacteriologist and Mr. G. A. Smith as Dairy Expert. Both of these gentlemen now have entered upon their duties, their work being located in the dairy section of the new building. Mr. Harding spent about six months of the year in very useful observation and study at the laboratories of Europe, in order to become familiar with current subjects and methods of European research.

At the time of my last report, the election of a botanist was in contemplation. After looking the field over thoroughly, it was decided not to go outside of the station staff in order to fill this position. The work of Mr. F. C. Stewart, who was located at Jamaica, L. I., pursuing investigations immediately related to the interests of Eastern New York, had been so satisfactory and promotive of practical benefit, that your committee having the matter in charge concluded to transfer him to the main Station, where he could have larger and more efficient facilities for the investigation of plant diseases. His work will now have a relation no less important to the agriculture of the Second Judicial Department than was the case under the former arrangement. Mr. Stewart has spent several months of the past year in Europe pursuing studies in plant pathology, returning to his work in August.

THE NEW BIOLOGICAL AND DAIRY BUILDING.

The most important accession to the Station buildings so far secured is the new laboratory which is designed to accomodate the departments of investigation along biological and dairy lines. Its erection was begun in September, 1897, and completed in September, 1898.

The accompanying description and cuts show as clearly as possible its appearance, construction and apparatus equipment.

The historical facts relating to the action of the Board of Control, legislation and the work of construction can best be presented by an extract from the report of the chairman of the building committee, Hon. A. C. Chase.

On Oct. 6th, 1896, the Board of Control of this Station requested the director of the Station to prepare such plans as he might deem necessary for the erection of a building to accomodate the biological and dairy departments of this institution. At a subsequent meeting of the Board held in Albany on Jan. 19th, 1897, plans presented by the director were approved and it was unanimously voted to ask the Legislature then in session for $41,000, with which to erect the proposed building.

This action was due to a clear recognition of the necessity for providing larger and more efficient quarters in which to locate the existing department of dairy investigation, horticulture and entomology and the departments of botany and bacteriology to be created. The sum of money named was the estimate of the State Architect based upon preliminary plans which had been submitted to him.

A bill framed in accordance with the action of the Board was introduced into the Senate by the Hon. John Raines and into the Assembly by the Hon. Murray Benham, gentlemen who ably represented this section of New York in the Legislature then in session, and who faithfully prosecuted and defended the interests of the measure which was placed in their charge.

The bill was favorably reported from both the Ways & Means and Finance committees and received unanimous passage in both the Senate and Assembly. It was sent to the Governor about the middle of April and was approved by him on April 21st, 1897. This act now constitutes Chap. 315 of the laws of 1897.

The unobstructed passage of this measure in a year when economy was the watch word and its signing by the Governor when it was entirely clear that many other requests must be denied are sufficiently noteworthy to call for some explanation. There was, first of all, a wide-spread and earnest representation to the members of the legislature by many of their prominent agricultural constituents of the desirability of the proposed enlargement of facilities for investigation at the State Experiment Station. The State Grange, the State Dairymen's Association and several other prominent agricultural organizations passed resolutions favoring the erection of the proposed building.

In the second place, those leaders in the Legislature who were in the position to exert a large influence upon legislation were favorable to the measure. It is but just also to remark that the President of the Board of Control, occupying as he did a seat in the Assembly, was able to carefully guard the interests of the Station, and he was faithful to his opportunities.

A committee consisting of A. C. Chase, S. H. Hammond, F. O. Chamberlain and W. H. Jordan was appointed by the Board to take charge of the construction of the building, and was authorized to make and execute all necessary contracts. Notwithstanding the fact that steps were taken on April 22d to secure plans and specifications from the State Architect's office, they were not placed in the hands of the building committee until nearly the middle of August, thus rendering it necessary to proceed with construction during cold weather. The committee promptly advertised for proposals for the erection of the building. Twelve were received which were opened on Sept. 8th, the sums mentioned varying from $23,689 to $34,088.

A. B. Morrison, of Geneva, was the lowest bidder and the contract was awarded to him at $24,214, this being an increase of $525 over the proposal on account of extras which were added to the original specifications. Later, proposals were received for installing the heating apparatus, the plumbing and drainage, the refrigerating plant, the temperature control system, the elevators, wiring the building and the lighting fixtures.

The awards were as follows:

Heating, Herendeen Mfg. Co., Geneva	$2,185 00
Plumbing and drainage, Emig & Hatmaker, Geneva	3,475 00
Refrigerating plant, A. H. Barber Co., Chicago	2,000 00
Temperature control system, Electric Service Co., of Buffalo	1,145 00

Elevators, The Houser Elevator Co., Syracuse..... 350 00
Wiring buildings, Geneva Power and Electric Light Co..... 425 00
Lighting fixtures, Oxley & Enos Mfg. Co., New York City..... 467 00

Ground was broken for the foundations of the building in September, 1897, and the work proceeded as expeditiously as the conditions would allow.

The style of the structure is certainly in keeping with its purpose, and must be commended for its quiet and simple dignity. The quality of the construction has been most thorough and satisfactory. This has not been due so much to the faithful and unrelenting inspection of the supervising architect, Mr. Charles F. Crandall, of Rochester, as to the ability and business integrity of the contractors. No matter how keen sighted and insistent an architect may be, he is often unable to secure desirable results at the hands of irresponsible builders. This institution is fortunate in having entered into contracts with men whose honorable purposes rendered their bonds a superfluous legal form. The building committee takes this occasion to express its appreciation of the most excellent plans and specifications furnished by Hon. I. G. Perry, State Architect, of the faithful and efficient services of Mr. Charles F. Crandall, of Rochester, Supervising Architect, of the most thorough and elegant plumbing and drainage work installed after the plans and under the direction of Henri D. Dickinson, of New York City, and of the thorough and honorable execution of their contracts by the several contractors mentioned above.

General construction.—This new laboratory stands about 300 feet east of the Director's office, facing north and fronting upon North Street. It consists of a main building, 88 by 38 feet, and two wings extending 30 feet to the rear, between which is an open court at the rear 16 feet in width, insuring ample light and ventilation to all working parts of the building. The front is in three sections of which the central one of 46 feet projects 4 feet. In front of this is a porch 9 feet wide and 41 feet long, with a veranda upon which doors open from the second story. The two stories, 11 and 10 feet in height, respectively, of both main building and wings are made of the best quality of cream colored pressed brick, and trimmed with Medina stone. The basement extends under all parts of the building and is 11 feet clear, the concrete floor being at grade in the rear, where doors into each wing, and into the main building from the court, give easy access. The elevators, one in front to the first story and one in the rear to both first and second stories make the delivery of supplies and the handling of the dairy products very convenient The basement and foundation walls are faced at all exposed points with Medina stone giving a pleasing contrast with the lighter colored brick. The

roof is of slate, with galvanized iron cornices, and is so shaped that the attic rooms are large and high. Abundance of light is given these rooms through six double dormer windows at the sides, a round window in front and a skylight above.

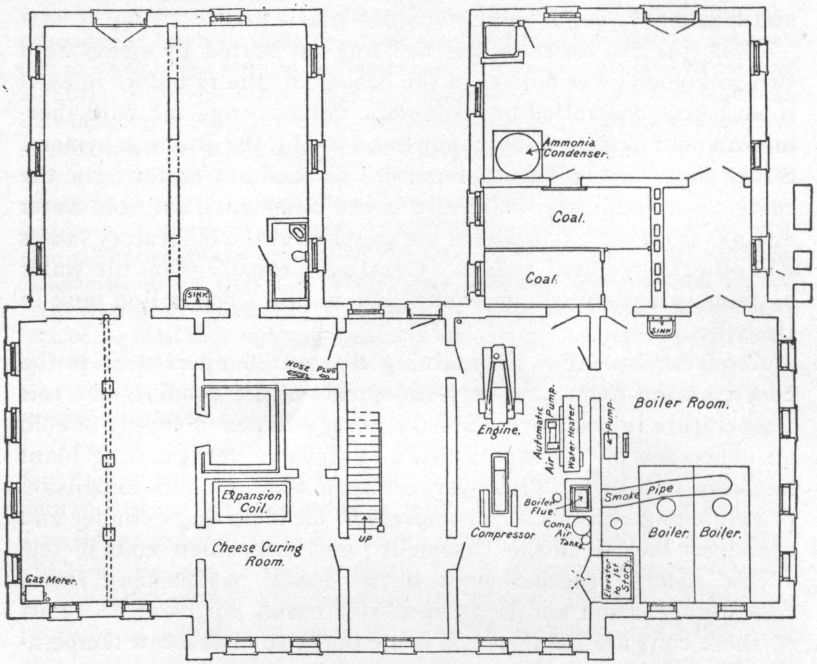
The interior is finished in quartered oak; hard plaster is used throughout; and the floors are southern pine except in the vaults and four dairy rooms, where vitrified tile is used.

Heat, gas and water.—The building is heated by steam from two 30-horse power boilers in the basement, the radiators in each room being controlled by automatic valves connected with thermostats and operated by compressed air by the Johnson system. Steam from the boilers, compressed air and hot water from the compressor and heater (both also in the basement), and cold water and gas from the city systems are supplied at the laboratory tables and other convenient points. Constant pressure upon the water systems is maintained by connection with a 1,000 gallon tank in the attic.

Refrigeration.—For maintaining constant temperatures in the cheese-curing rooms and bacteriological culture rooms and a low temperature in the dairy and cold storage rooms a supply of cold air is necessary. To secure this an extensive refrigerating plant has been installed. This operates upon the ammonia-expansion principle and consists of a compressor, oil removing cylinder and condenser located in the basement; and expansion coils in one cheese room in the basement, butter room, pasteurizing room, cold storage room and large insulated rooms in the attic. Part of these coils are immersed in brine tanks so that a low temperature, secured during the day, can be maintained during the night without running the machinery. The power for the compressor and other machinery is furnished by a Straight Line, high speed, center crank horizontal engine which, at a steam pressure of 70 pounds and speed of 260 revolutions, gives about 25-horse power.

In refrigeration the gaseous ammonia is drawn from the expansion coils and passes through the water jacketed compression cylinder where it is liquified by a pressure of from 150 to 200 pounds. On its way to the cooling coils and tank the liquified ammonia passes through a long, slender cylinder where, by the action of gravity, it is freed from the oil used in lubricating the compressor. In the coils of the condensor the heat is drawn

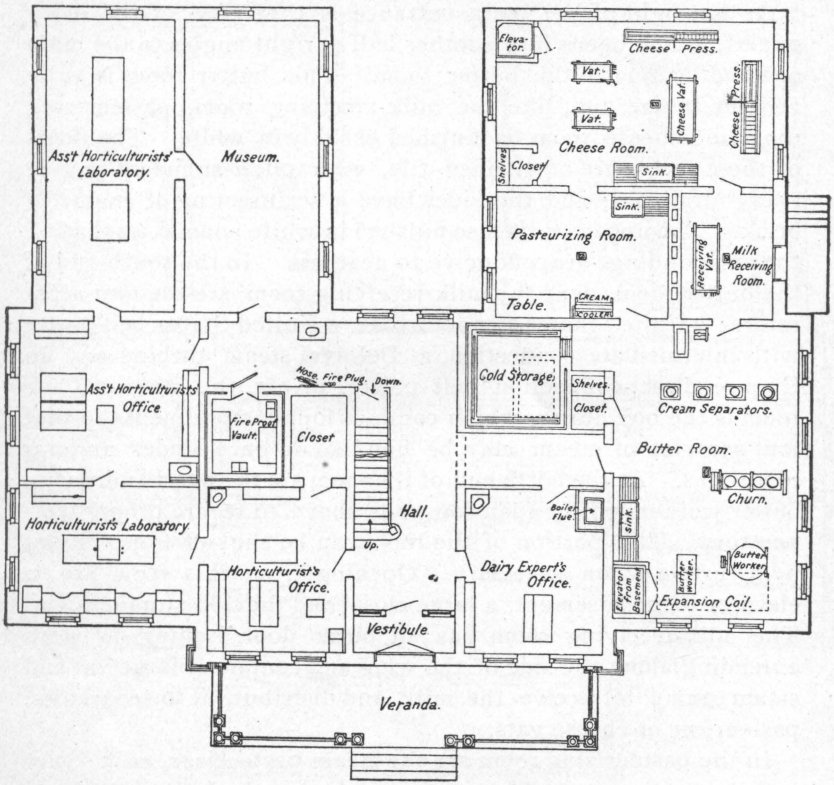
from the ammonia until the latter reaches the temperature of the city water surrounding the coils. From the cooling tank the liquid passes to the expansion coils as required and by its rapid evaporation, controlled by expansion valves, withdraws the heat from the air or the brine surrounding the coils. The temperature can be reduced to a point far below freezing.



BASEMENT PLAN OF BIOLOGICAL AND DAIRY BUILDING.

Departments and their equipment.—Handsome oak and glass doors lead into the entry from the front and from the entry into a central hall and staircase. Occupying the left side of the main building and the east wing are the five rooms devoted to horticulture. These consist, in succession from the entrance and all communicating, of the horticulturist's office, 18 by 15 feet, with a large dark closet attached; horticulturist's laboratory, 20 by 14 feet; assistant horticulturist's office, 20 by 17½ feet; assistant horticulturist's laboratory, 32 by 14⅓ feet; and museum, 32 by

14⅔ feet. The offices here, as throughout the building, are provided with large roll top desks, revolving bookcases, specially planned and commodious wall cases and comfortable desk and office chairs, all of the furniture being of oak. The laboratories each have a large work-table, with Alberene stone top and sink, fitted with the conveniences previously mentioned. The win-



FIRST FLOOR PLAN OF BIOLOGICAL AND DAIRY BUILDING.

dows are provided with wide microscope tables or shelves and these as well as the projecting ledges of the microscope and reagent cases, are fitted with removable glass tops to prevent staining. Adjustable spring-back chairs are also provided for the microscopists.

Facing the door of the horticultural museum and just across a narrow hall is one of the fire proof vaults for the preservation

of records, the other vault being upon the second floor, just above this one. The museums, also, are practically fire-proof.

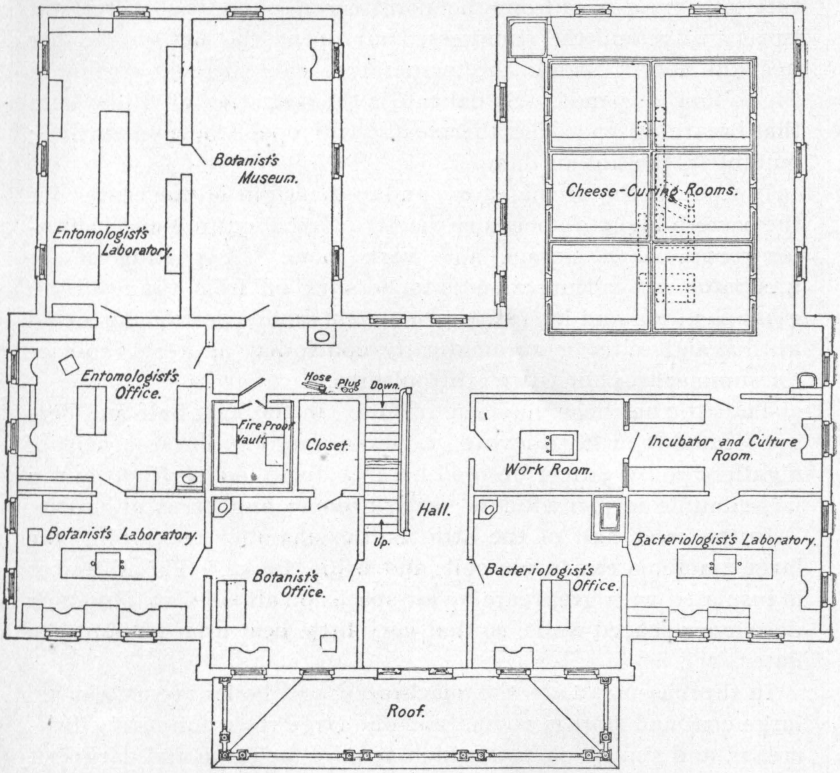
The narrow hall referred to above is at right angles to the central hall but does not extend across it to the right. From this hall, upon the same side as the vault, lead the door and stairway to the basement.

At the right of the main entrance is the office of the dairy expert, which opens into another hall at right angles to the main one and leading to the butter room. This butter room is 32 by 20 feet in size and, like the milk-receiving room, pasteurizing room and cheese room, is finished entirely in white. The floors of these rooms are of vitrified tile, with pitch sufficient to give ready drainage; and the sides have a wainscoting of enameled brick. The apparatus is also finished in white enamel, so that all the surroundings are conducive to neatness. In the south end of the butter room, next the milk-receiving room, are the four separators; a United States steam turbine, a United States belt power with intermediate connection, a DeLaval steam turbine and an Empire direct-connection belt power. Near the middle of the room is the box churn, which contains four compartments so that four samples of cream may be handled at once under uniform conditions. At the north end of the room are the hand and power butter workers with expansion coils above to secure proper temperature. This portion of the room can be shut off from the rest by a curtain when necessary. Opening from this room are an elevator to the basement, a large closet and the cold storage room. The milk-receiving room has an outer door leading to steps extending along the side of the wing and contains a large vat and steam pump to receive the milk and distribute it to separators, pasteurizer or cheese vats.

In the pasteurizing room are the steam pasteurizer, milk cooler and Babcock tester. The upper coils over which the milk flows in the cooler circulate cold water and the lower ones ammonia, so that economical and rapid cooling is secured. The cheese room communicates by an elevator with the basement and with the second story near the cheese-curing rooms, and contains one large and two small cheese vats, one large constant pressure press and one small one.

Upon the second floor are found a central hall and staircase as

below and the arrangement of rooms in the east half does not differ from that of the first story. These rooms are, in succession as before, the botanist's office, botanist's laboratory, entomologist's office, entomologist's laboratory and botanist's museum. The hall between the museum and vault, however, extends entirely across the building to the west wall and forms part of the



SECOND FLOOR PLAN OF BIOLOGICAL AND DAIRY BUILDING.

insulation of the block of cheese-curing rooms. These cheese rooms occupy the west wing and are separated from its outer wall on all sides by a 4-foot passageway. They are further insulated by double walls and air spaces on the outside and between the separate rooms. These rooms are six in number, each 9 by 10 feet, and each provided over the entire wall space with shelves 14 inches wide and 12 inches apart. It is expected to control the

temperature in each of these rooms within 2 degrees, running each room independently and at any degree between 30 and 90. A hot air flue from below and cold air flue, from the chamber in the attic containing the expansion coils and brine tanks, lead into each room. These flues are closed by dampers operated by compressed air and controlled by thermostats. When the temperature falls one degree from the point fixed upon, the thermostat turns a valve and the compressed air opens the hot-air damper near the floor. Should the temperature rise, the cold air flue in the ceiling is opened. So delicate is the operation of this system that breathing upon the thermostat will open the cold air flue; fanning it, the hot air damper.

In front of this second story and to the right of the center are the bacteriologist's laboratory, bacteriological culture and incubator room and a storage and work room. A portion of the incubator and culture room is to be shut off from the rest by a glass partition and its temperature held where desired by a cold air flue and radiator automatically controlled, as a convenience for summer work with gelatin cultures.

The attic has been finished off only in the east half and here are located the rooms devoted to photography. These consist of a gallery 36 by 34 feet, lighted by an 8 by 10 foot skylight and a large double dormer window; a dark room; and a finishing room.

In the west half of the attic is the chamber containing the large ammonia expansion coils and brine tanks. This chamber is insulated with great care by air spaces on all sides and by thick double-air-spaced walls, so that very little heat from without can enter.

In the basement are the machinery and boiler rooms, several large coal and storage rooms and one large room for curing Brie, cream, and similar cheeses which require moisture and darkness. This room is also provided with cooling apparatus.

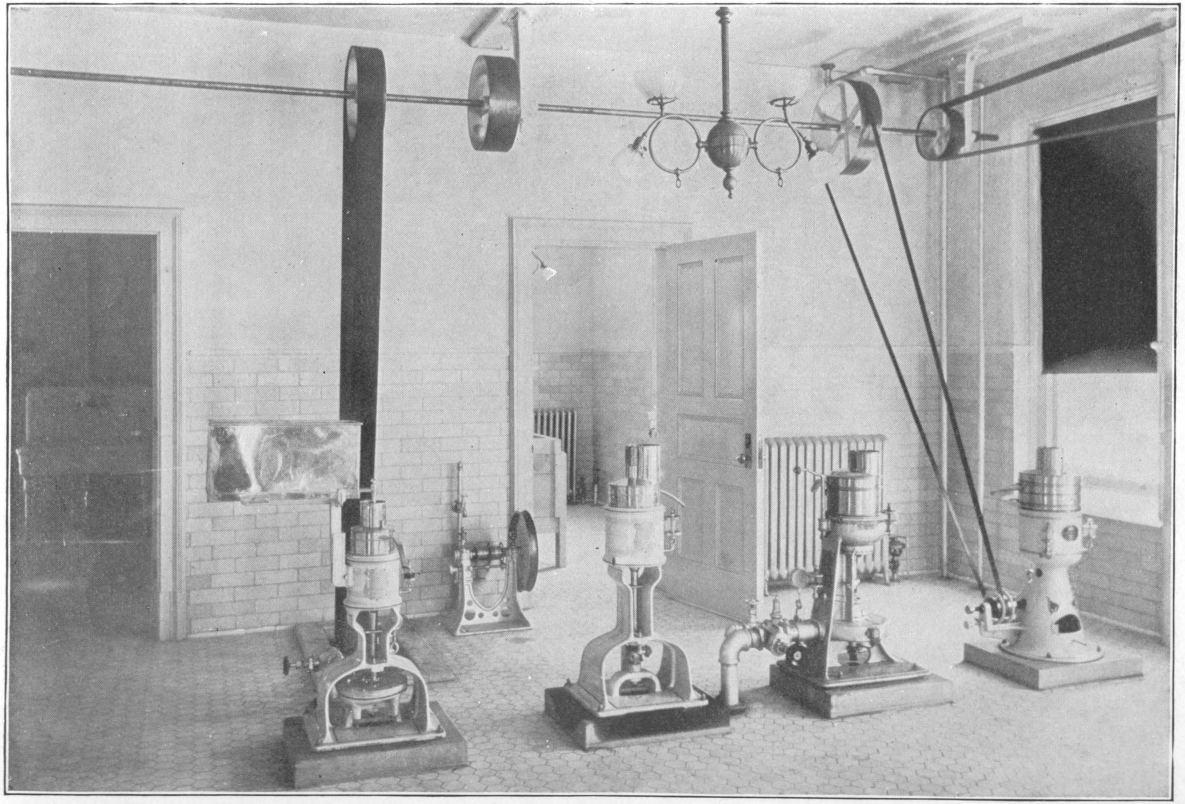
USES OF THE BIOLOGICAL AND DAIRY BUILDING.

In order that the people of the State may be reminded of the real relation this new structure bears to Agriculture as an art, I take the liberty of reproducing here remarks that I offered at the dedicatory exercises which occurred on Sept. 21st, 1898.

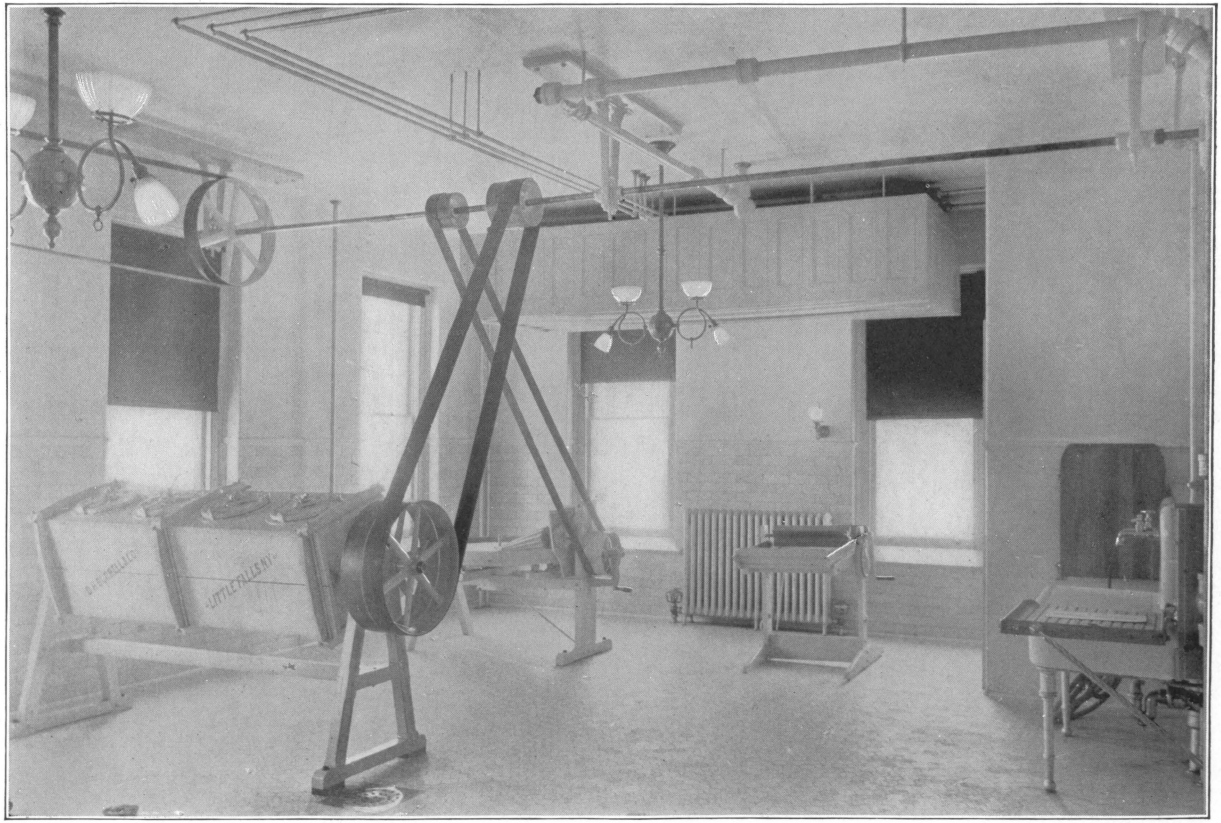
It is not necessary to state what all clearly understand, that this building

BOTANIST'S LABORATORY.

VIEW IN OFFICE AND LABORATORY OF ASSISTANT HORTICULTURISTS.



South End of Butter Room, Pasteurizing Room and Receiving Room.



North end of Butter Room.

has not been erected simply for the sake of adding one more structure to those previously possessed by this Experiment Station. A larger and more useful purpose has been in view. What this is, doubtless many have asked to-day, in thought if not in word. It will aid in answering this very pertinent question if we refer to certain statements, contained in the report of the Director of this Station for 1896. In discussing the proper work of this institution it was declared that "horticulture and dairying occupy a commanding position in New York Agriculture" and it was subsequently stated that "everything points therefore to the conclusion that the experiment stations of this State should give prominent consideration to whatever will promote these two lines of practice."

This building is one step in the pursuance of the policy thus enunciated. It is to harbor, as the report of the building committee states, the departments of dairying and horticulture, with those of botany, bacteriology and entomology, the three latter being really largely adjuncts of the two former. Dairying is an art, but it is one that is being materially modified by the results reached through chemical and bacteriological research. Horticulture is also an art, a many sided one, and it is each year becoming more and more dependent upon the information supplied by the botanist and entomologist.

Another statement was made in the Director's report for 1896, which is also pertinent to this occasion, and which is quoted at length: "If we base the reply to this question (how can the farmer's interests best be served?) upon experience, the answer must be that the farmer will best be served even from a business point of view by a rigid inquiry into the facts and principles which underlie his practice. The knowledge which, in its application to agriculture, has been in the past fruitful of the best results, is that which has come from investigations in the field of pure science, and this will undoubtedly be true in the future. Tests of theories and illustrative experiments in matters pertaining to the business of farming are useful and even necessary, but all safe and permanent advance must proceed primarily from a study of fundamentals. Judged in the light of these statements, then, the real function of the Experiment Station is to conduct severe scientific inquiry in those lines related to the practice of agriculture and therefore the controlling policy of this Station should be to strengthen and develop its facilities for making such reseach exhaustive and conclusive." In providing these laboratories this Experiment Station is trying to live up to its declaration of principles. What is to be the work of the horticulturists? Certainly not merely to study the cultural side of the fruit grower's business, but to discover and formulate those laws of plant life which control all the practice of the garden and field. Prof. Beach will use the implements of research more than he will the pruning knife, however essential the latter may be.

It is not expected that the botanist, Mr. Stewart, will devote himself wholly to naming new or unusual plants or to explaining how to eradicate weeds, but much of his time will be spent in searching out the hidden processes which have their course within the tissues of plants. The microscope, the sterilizer and the incubator will be his tools. The bacteriologist will also

be a student of those minute organisms which seem to have so profound a relation to man's welfare, and this member of the Station's staff will be most useful when he is most scientific. Possibly he may spend days or months hunting for a single fact in the life history of one of these germs. The entomological laboratory is not built simply to contain a collection of "bugs" although it is very important to have such a collection for reference purposes.

Mr. Lowe will seek first for the life history of these little animals, both troublesome and useful, and when he is successful he will secure the data that are most valuable.

We shall come nearest to the practice of an art in the dairy department, but the practical operations of the butter and cheese room will not be of a commercial character. Our dairy apparatus and our unique cheese-curing rooms are put into the hands of our dairy expert simply that he may coöperate with the chemist and bacteriologist in discovering the facts and principles fundamental to a proper control of manufacturing processes. Unusually fine equipment exists not to admire but to use in learning the effects of temperature and other conditions upon the compounds and organisms of our dairy products.

Is any one skeptical about all this effort being of use to agriculture? He may quiet his fears, for the history of the past shows that the tiller of the soil will ultimately reap a benefit. This building is also to have, we trust, an important relation to the higher range of human knowledge. No facts that pertain to the universe of matter and of life are useful to one art alone. The science which the farmer uses is science for the whole world, and is essential to every man who must both master and obey physical forces in the practice of an art or profession.

THE DEDICATION OF THE NEW BUILDING.

It would be a serious omission if the history of the Station for the past year was reviewed without mention of the dedication of the new building which occurred at the Station on Sept. 21st. The circumstances attending that occasion were auspicious. The day was fine and the distinguished visitors who were expected to participate in the exercises were, in nearly all cases, Providentially able to be present. The attendance both local and from distant parts of the State was very gratifying. Probably not less than three thousand people visited the Station grounds during the day. It was a collection of men and women representative of the best thought and effort in New York agriculture and their presence on that day in an attitude of sympathy towards the Station and its work was an encouragement and an inspiration.

In order to accommodate this large number of people, a tent

with a seating capacity of 2,000 was erected adjacent to the Station grounds and it proved to be a very pleasant and convenient auditorium.

Addresses of a high order of merit were delivered here during both forenoon and afternoon. Good music was very kindly furnished by the Willard State Hospital band, for which favor I desire to make most appreciative acknowledgement.

The Station was epecially favored on that day by the presence of Hon. James Wilson, Secretary of Agriculture, who, notwithstanding the severe pressure of great responsibilities found time to personally express his interest in New York agriculture.

Among other distinguished gentlemen present were Congressmen S. E Payne and James W. Wadsworth, Maj. H. E Alvord of the U. S Department of Agriculture, Ex Gov. W. D. Hoard, of Wisconsin, Hon. Charles W. Garfield, of Grand Rapids, Mich., Senator John Raines, Hon. F. E. Dawley, Hon. S. B. Richardson of the State Department of Agriculture, Hon. A. R. Eastman, President of the State Dairymen's Association, Profs. I. P. Roberts, L. H. Bailey and H. H. Wing of Cornell University, Dr. R. E. Jones, President of Hobart College, Hon. Geo. E. Powell and many other prominent agriculturists.

Special mention should be made of the presence of Prof. S. W. Clark and Hon. J. S. Woodward who were honored members of the first board of control of the Station when it was inaugurated some eighteen years ago.

Formal addresses were made by Sec. Wilson, Ex Gov. Hoard and Mr. Garfield, Pres. Jones, Prof. Roberts and Mr. Schraub and remarks were offered by Congressman Payne and Senator Raines, to all of which the large audience listened with evident approval. The exercises of the day were highly complimented on all sides.

Outside of the speaking the new building was the center of attraction, although an elaborate display of fruit and the other buildings and equipment of the station proved to be objects of general interest.

In the evening the reception given by the Board of Control was very largely attended, the rooms of the new building being crowded until a late hour.

A most excellent and comprehensive report of the entire proceedings of the day was made by an enterprising local paper, the *Geneva Courier*.

THE NEW POULTRY HOUSE.

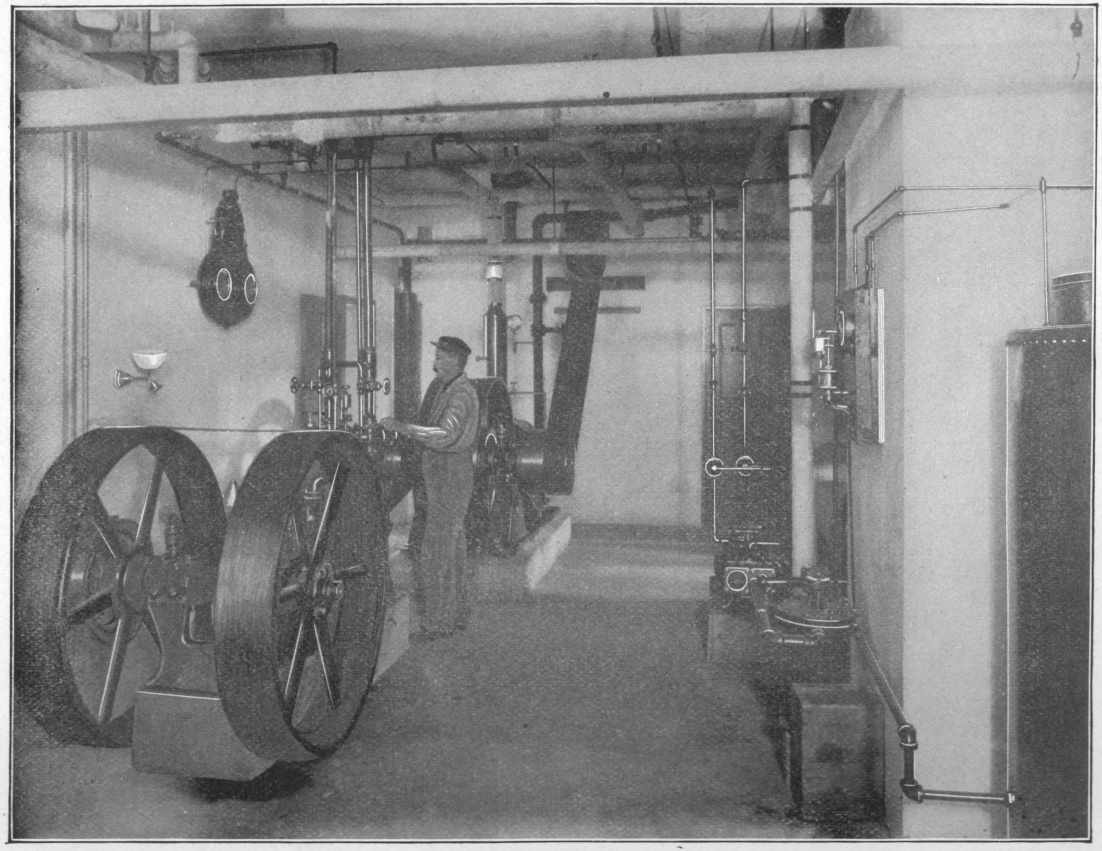
The new poultry house is located where the only dry site was available, some distance from most of the other Station buildings. The size and general arrangement of this building are shown in the accompanying plan-drawing.

The central portion of the building is higher than the wings and has a basement, part of which is used for an incubator room and part occupied by a hot-water heater and coal. From the incubator room two eight-inch ventilating pipes run to the loft. The first floor is used for a work room and one part as a sleeping room for the poultry man. The loft is used for storage.

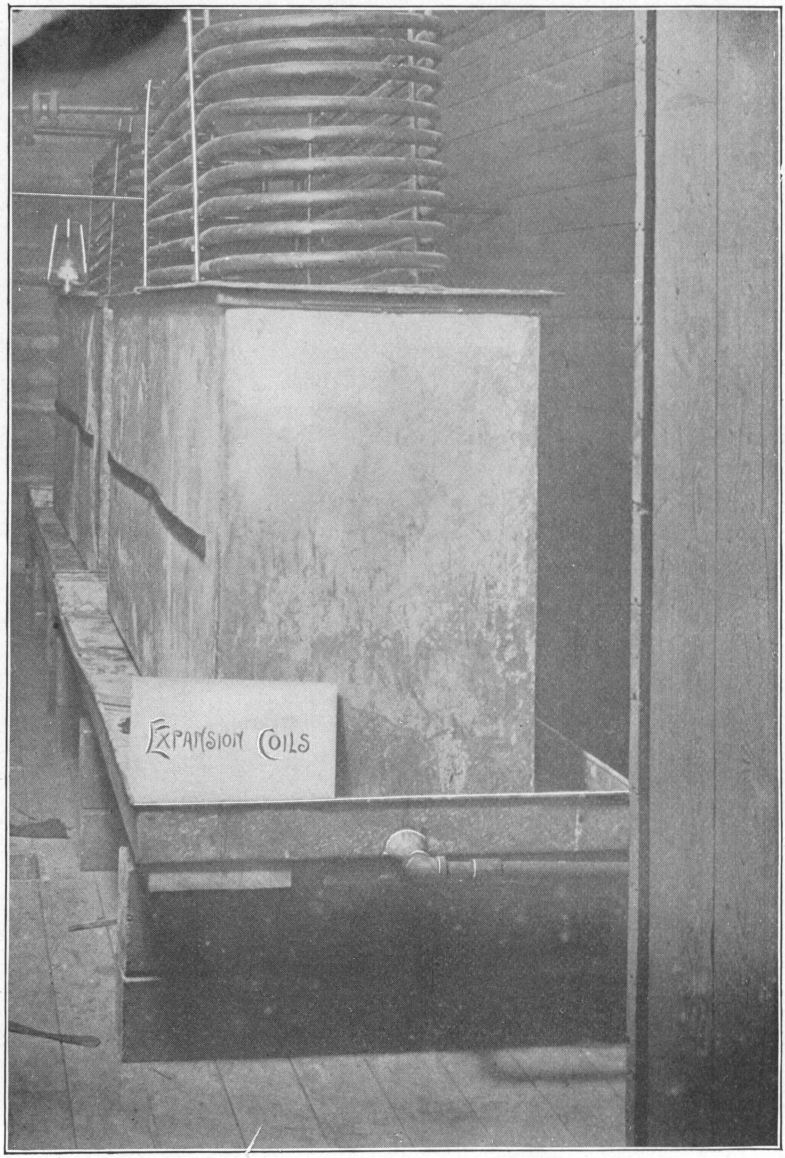
Toward the end of the brooder wing are four pens in which can be used separate lamp brooders. A row of eight brooders is heated by pipes of hot water. Back of these brooders is a sunken passage-way connected with the heater room of the basement. This is covered by a trap floor which may be hooked back when desired. When working in this passage-way the brooders are at the height of an ordinary work bench. Four of the brooding chambers are 2 ft. x 3 ft. and four are 2 ft. x 4 ft. on the floor. Four flow-pipes of hot water run through the brooders immediately over the chicks and two larger return pipes run underneath the tight floor. The brooders are separated by air chambers or boxes from which fresh air is admitted at each end of the brooder chamber through screened covered openings. Doors from the air box open into the passage-way so that pans of hot water to supply moisture may be placed on the return pipes.

These air boxes are not separated from the long enclosed space under the brooders through which the return pipe runs. A damper admits fresh air from the passage-way to the space under each brooder so that a current of air may pass under the floor of the brooder over the return pipes then into the air box over the moisture pans and enter the brooding chamber near the flow pipes. The front of the brooding chamber is open, the floor being level with the floor of the pen, but can be closed when desired by a door of wire netting. The rear wall, partly of glass, is securely attached to the cover which is hinged and lifts against the partition. The brooder covers are strong so that collectively they form raised walk. Wire netting doors open into each brooder pen.

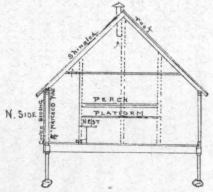
The wing at the left contains a feed room and four pens for



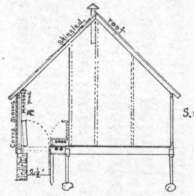
AMMONIA COMPRESSOR, ENGINE AND COMPRESSED-AIR PUMP AND TANKS.



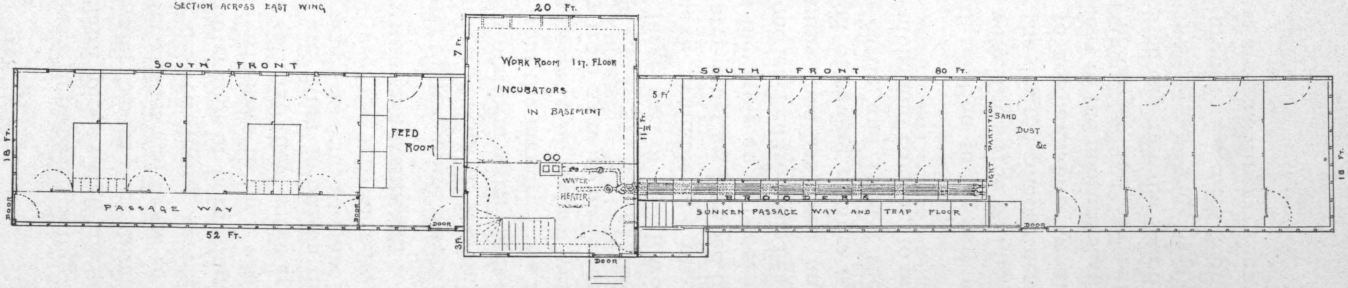
AMMONIA COILS AND BRINE TANKS.



SECTION ACROSS EAST WING



SECTION ACROSS BROODER WING



GROUND PLAN OF POULTRY HOUSE

breeding stock. This wing has a tight board ceiling. Trap doors open into the loft and ventilator pipes extend through the roof. A pipe connected with the water heater runs through this wing along the floor under the water dishes and nests, so it is possible to warm the room slightly if desired during very cold weather. The sides at the rear and the outer ends of both wings are double, enclosing an air space. The windows in each wing are of one sash and hinged at the side so that they serve as doors to the open runs. Storm windows are fitted to button on outside for use during cold weather.

OTHER BUILDING IMPROVEMENTS

Some years ago a large water tight manure platform, about 100 x 40 ft., constructed of grouting and cement, was built just south of the cattle barn. Under this platform water tight cisterns were located to catch all drainage from the manure. As this platform had no covering, and as the records of sixteen years show the rainfall of this region to vary from 22 to 36 inches annually, it is plain that approximately from 230 to 375 tons of water would fall annually on this platform, a large part of which would run into the cisterns. In order to make available the plant food taken into solution, all this rain water must be pumped into carts and distributed on the land, thus incurring an expense much greater than the value of the plant food leached from the heap of manure. In view of these facts, a manure shed has been built over this platform. The wisest method of saving manure is to use sufficient absorbents behind the cattle, and then if the manure is stored, to keep it sufficiently moist and compact to prevent excessive fermentations.

This shed is so placed with relation to the new piggery mentioned later, that if it seems wise, the swine will be given access to the manure, thus securing the desired compactness.

A new piggery, designed to accommodate twenty or thirty swine, has been erected adjacent to the manure shed. This was made necessary by the need of proper and convenient storage space for farm machinery which can now be found in the basement of a barn formerly used for swine. This basement is to be renovated and finished with a grout and cement floor and used for storing the smaller implements and machinery when not in use.

An important change has been made in the basement of the cattle barn by doubling the window space and by substituting a wooden wall for the stone masonry in the south end. With the increased light and dryness thus secured this basement appears to furnish comfortable and healthful quarters for live stock.

In view of the need for much more milk to be used in the new dairy building, it will be necessary to enlarge the stock capacity of the cattle barn. This can only be done by building a wing, one story probably, and most conveniently on the east side, that will accommodate twenty or thirty animals. I recommend that $1500 be secured for that purpose. I also recommend that $1000 be secured for the maintenance of general repairs to the Station buildings. The general funds appropriated for the use of the Station should be wholly applied to the maintenance of its various departments and must be if it is conducted along the varied lines that are now undertaken.

THE STATION PUBLICATIONS.

A recent count of the names on our mailing list shows that the popular bulletins are being distributed as follows:

Popular Bulletin List.

Residents of the State of New York	29,697
Residents of other states	716
Newspapers	732
Experiment Stations and Experiment Station staffs	814
Miscellaneous	131
Total	32,090

The complete bulletin list is comparatively small.

Complete Bulletin List.

Experiment Stations and officers	752
Libraries, scientists, etc	136
Foreign list	52
Individuals	290
Miscellaneous	131
	1361

It has now been nearly two years since the Station began the publication of the so-called popular bulletins. So far experience seems to justify the decision to issue this form of publication. A few criticisms have been met but as a rule the opinions expressed have been those of approval. The relative appreciation of the complete and popular bulletins may be judged by the requests for

the former which are sent to the Station. Every copy of a popular bulletin contains a statement that if the recipient prefers the complete bulletins they will be sent to him regularly. Notwithstanding this offer, less than three hundred such requests have come from more than thirty thousand persons.

The Station mailing list is steadily growing. During the last five months it has increased over eight hundred names, mostly in response to requests sent to this office.

RELATION OF THE STATION STAFF TO FARMERS' INSTITUTE WORK.

There are various instructional and research efforts now maintained in the interests of farmers, whose lines more or less intersect. The teachers in our agricultural colleges are to some extent investigators and they are found often on the institute platform. The experiment station worker, whose chief function is to investigate, is frequently taxed severely by requests to serve as an institute speaker, as well as to give class room instruction, when the experiment station is a department of a college. This interrelation of these distinct but at the same time closely related lines of effort is often the occasion of more or less perplexity.

The State of New York is maintaining an extensive system of farmers' institutes, requiring the services constantly during the winter months of a large number of speakers. The persons who are qualified to act in this capacity are in the main only those who can speak attractively with authority concerning some special subject important to agriculture. Such popular teachers are not abundant. For this reason, the members of this station staff are constantly sought, not only by the officials who have the institutes in charge, but by the farmers themselves, to appear on institute programs, a condition of affairs which looked at from one point of view is a proper cause of gratification. It is an omen of good that the agricultural masses have come to regard the truths of science as useful to them and their art. It is fortunate, also, that the scientists at an experiment station have the opportunity to come into sympathetic contact with those in whose interests they are working. A personal relation is thus established which is promotive of mutual confidence and understanding. Besides, while the farmers may learn much from the

student of science, the latter may in return gain from the practitioner new views of the relations of truth to the art he is seeking to benefit, and thus be guided in giving to his researches the direction of greatest usefulness.

It is necessary, however, in order to understand the situation to view this matter from another standpoint.

The primary function of an experiment station is investigation, not instruction. This statement may disagree with popular opinion, but it is nevertheless correct. This being true, there are two facts which it is important to consider :

1. Frequent calls, at intervals more or less distant, for service as speakers at institutes, is a serious encroachment upon the mental status and consecutive effort of the investigator. This is true both with reference to laboratory study and to the discussion of results.

The chemist, the botanist or the bacteriologist, when once he has entered upon a series of observations is seldom able to turn aside to other matters without serious loss, and when in the midst of the discussion of results, with his mind saturated with the data he is to present, he connot temporarily transfer his mental activity to another subject without seriously checking his momentum along the main line of thought.

2. The teaching habit, especially in a popular way, cannot be considered as an aid, and may easily be a hindrance, to the close analytical mental processes along technical lines which are essential to success in scientific studies. This may explain why the platform efforts of many of our ablest men of science, who seldom attempt popular discussions, are characterized as " dry," while on the other hand the scientist who gives himself over to cultivating popular ways of speech and thought often finds himself drifting away from a love and aptitude for severe research. It is not impossible, nor perhaps very unusual, for men of scientific attainments to be efficient public speakers, but nevertheless we cannot ignore the essential difference between the mental status required for popular instruction and that necessary to rigid scientific inquiry.

Certainly that statement so often heard that contact with the people is necessary to the investigator is not substantiated either by theory or observation. Some of the most profound and use-

ful discoveries in science have been reached by men who seldom emerged from their laboratories, and certain American experimenters whose efforts have been fruitful of important results are those who are seldom heard in public.

The situation in New York is such as to require a careful adjustment between the experiment station and the institutes in order to best promote the success of both. On the one hand farmers should not assume that the members of the station staff are most useful to them when they speak from the platform, because this is seldom true. They should not be too insistent in their demands for platform effort. On the other hand some systematic and well understood arrangement should be made so that the station workers can anticipate interruptions and thus make such plans as are necessary to an economical use of time. If one of the station staff is to address ten institutes he should be allowed to do this as nearly consecutively as possible. It is easily possible to spoil a month's time for this amount of speaking where only one or two days are used in a week. The above statements are made with a full recognition of the strong sympathy which exists between this station and the institute effort, and of the greatly increased strength and influence this institution has gained from the opportunities which are made possible through the helpful attitude of the Director of Farm Institutes.

WORK IN THE SECOND JUDICIAL DEPARTMENT.

This work during the year 1898, was directed chiefly towards the care and production of three crops, potatoes, cucumbers and onions, which are very important ones in Eastern New York. The experiments conducted have involved during 1898 the use of approximately 20 acres of land located at various points in the Second Judicial Department. It is seldom that experimental work is productive of results more highly and immediately useful then has been the case with those relative to the use of fertilizers on potatoes and of fungicides and insecticides on potatoes and cucumbers. These results as related to potato growing and cucumber blight are fully presented in the Station bulletins and are to some extent reviewed on subsequent pages. Experiments on the prevention of onion smut have been in progress two years and will be continued longer before an attempt is made to formu-

late conclusions. Experiments in the production of chestnuts were also begun two years ago, concerning which nothing will be published at present.

CHEMICAL DEPARTMENT.

Fertilizer inspection.—In my report for 1897, attention was called to the unsatisfactory condition of the sale and inspection of commercial fertilizers. It was stated that the brands of fertilizers have increased to an absurd number without thereby serving any good purpose but rather causing confusion and unnecessary expense. The situation has grown worse rather than better. In 1898, nineteen hundred brands were registered in this office and the station actually collected for analysis 1427 samples representing 901 brands, at an expense greatly above the money appropriated by the State for this purpose. No such burden is laid upon an experiment station in any other State simply because in all other States the fertilizer trade either through a license fee, analysis fee or a ton tax, pays the expenses of inspection. In New York the State is assessed, and manufacturers, without additional expense to themselves may add a new brand, even if not more than a carload is sold. If the creation of the new names had any significance or value whatever, there would be less cause for criticism. As it is, hundreds of the brands sold in New York are essentially alike in the plant food which they furnish, nearly all of the so called special fertilizers having no scientific or practical justification. It is not necessary to create a new brand every time a farmer or body of farmers wishes for a particular mixture of plant food, neither is it necessary to humor the desire of every local trader for a brand in his name, thereby causing large expense to the State.

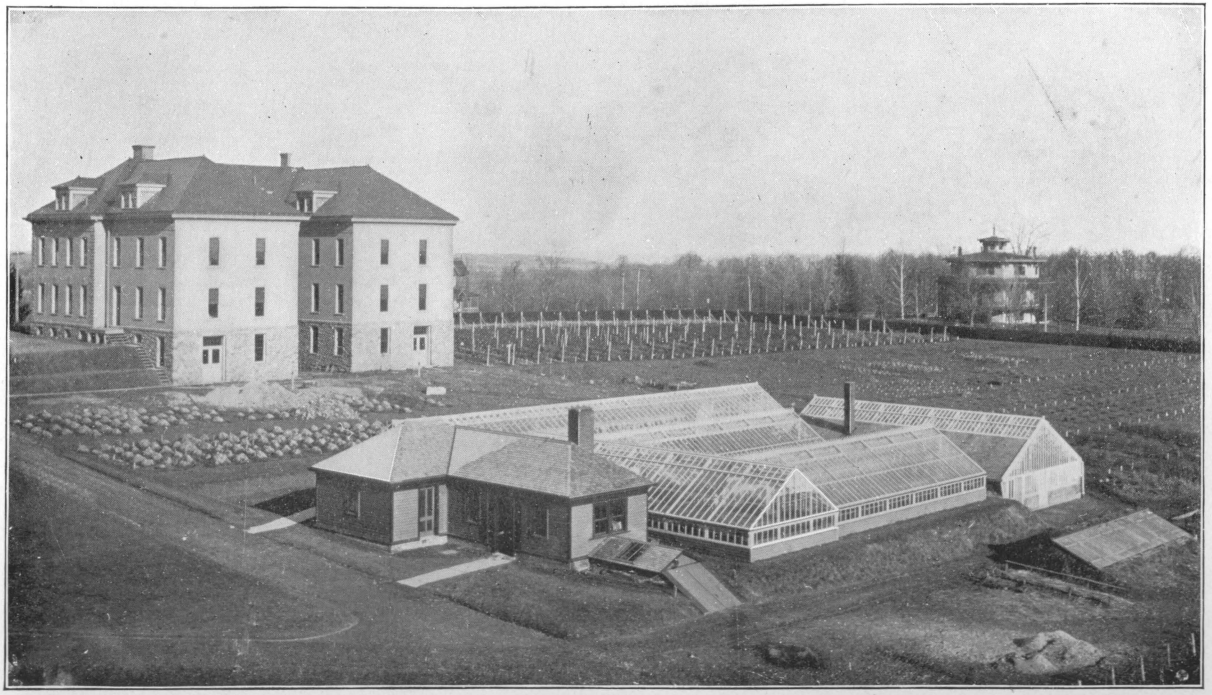
In view of this situation I recommend that the legislature of 1899 be asked to require the payment of a license fee for each brand of fertilizer put upon the market. Out of twenty-nine States which require fertilizer inspection New York is the only one which pays the expense from the State treasury.

I desire in this connection to call especial attention to certain facts presented by Dr. Van Slyke in Bulletins 145 and 148, relative to the fertilizer trade.

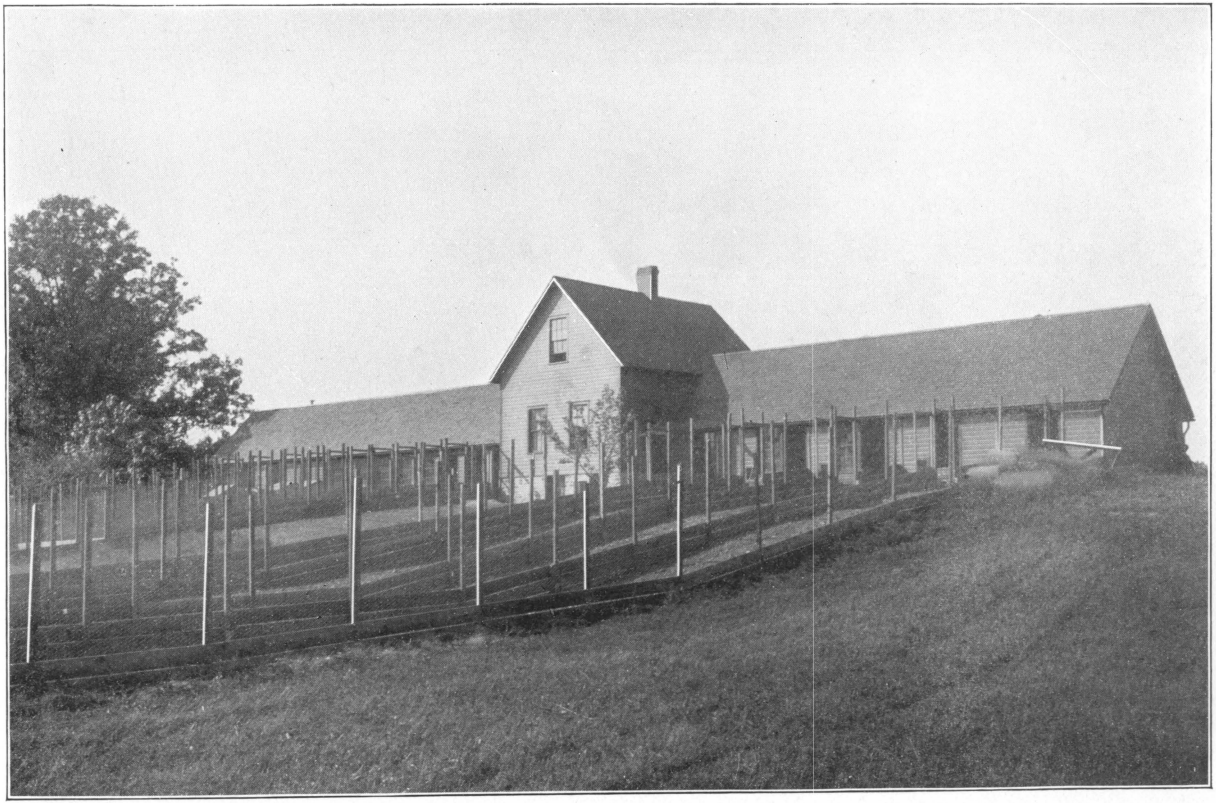
Few matters are more important to agriculture at the present

time than is the extensive traffic in plant food. It is estimated by the U. S. Department of Agriculture that in 1896 there was sold in this State 150,000 tons of fertilizers at a cost to the farmers of $4,621,500. But one other State is a larger consumer of these goods than is New York, due in part to her extensive market gardening interests. Without discussing the question whether so large a purchase of plant food is wise or even necessary, it is safe to affirm, on the basis of the facts contained in the above mentioned bulletin, that this expenditure might be materially reduced by improved methods of buying, methods which require no unusual knowledge or intelligence.

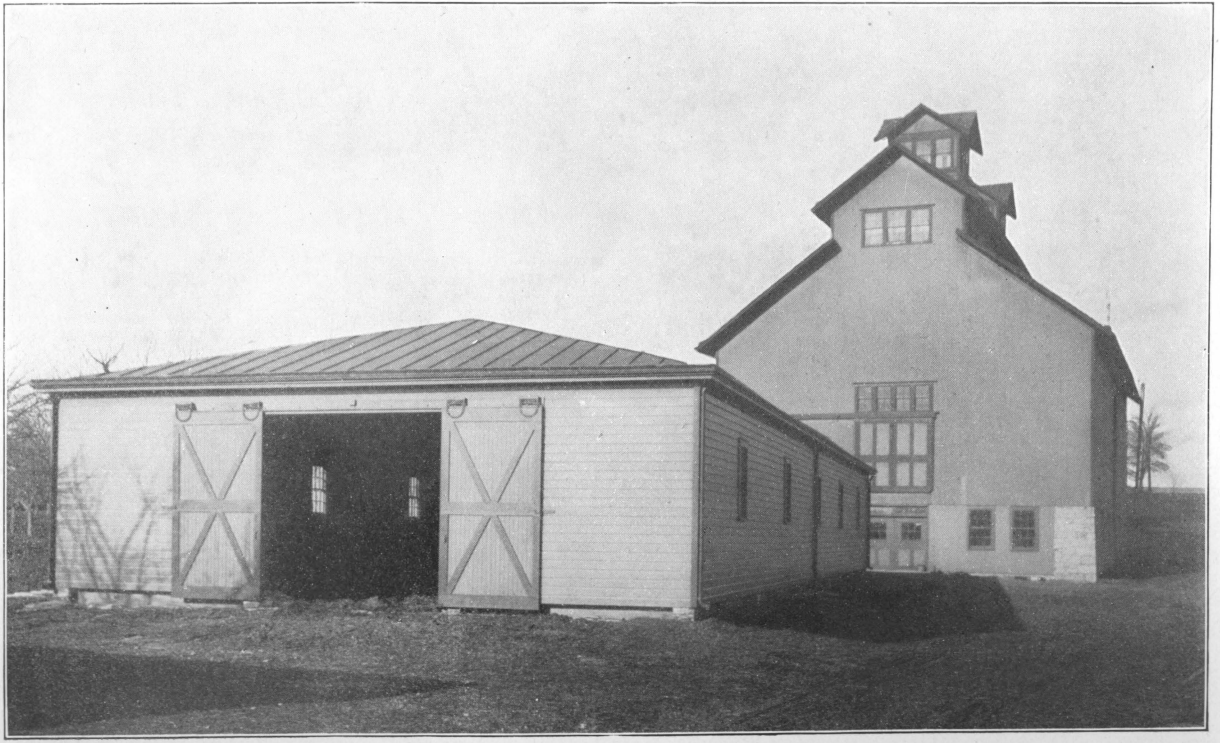
Dr. Van Slyke shows that the fertilizers sampled in the spring had an average selling price $9.13 in excess of the commercial valuation, the excess in the case of the fall goods being $5.28. This was nearly fifty per ct. of the commercial valuation of the spring goods and thirty-three per ct. the fall goods. Now it is an actual fact that farmers' clubs, or even individual farmers in New York not too remote from railroads, can purchase nitrogen, phosphoric acid and potash delivered at their farms, for not more and often for less than the prices named in the schedule of valuation. In the case of phosphoric acid in acid phosphates it can now be bought at a price below the valuation named, viz. 4½ cents per pound. Very recently phosphoric acid has been delivered to buyers in Central New York through an agent of the manufacturers at less than 4 cents per pound. As a matter of fact thousands of tons of fertilizers are now purchased annually in this State greatly under the usual retail cost of similar goods. Farmers often write to the Station, naming sums at which they can buy certain mixtures of local agents, prices which are positively extortionate, and the remedy lies either with the club system or in the purchase of unmixed materials to be mixed on the farm. Many of the 195 individuals and firms who register as manufacturers are not really such; they are only mixers; that is, they buy acid phosphate, potash salts and nitrogenous materials and mix them together in various proportions, give names to the different combinations and then retail them to the farmers. All this is unnecessary. Farmers can do their own mixing, and the interposition of the so-called manufacturer adds nothing to the value of the plant food purchased. Many of the real manufacturers stand ready to see



BIOLOGICAL AND DAIRY BUILDING AND FORCING HOUSES.



REAR VIEW OF NEW POULTRY PLANT.



MANURE SHED.

NEW PIGGERY.

the chemicals and raw materials separately or compounded in any proportions desired and hundreds of farmers are now taking advantage of this opportunity.

Sugar beets.—During the past season, much attention has been given to the sugar beet crop. Besides somewhat elaborate experiments on the Station farm, we have co-operated with eighteen farmers growing half acres of beets in eleven counties in Central New York, and have distributed small quantities of seed to a large number of other farmers. In all, 343 samples of beets have been analyzed, including those from the Station experiments and those grown from seed distributed by the Commissioners of Agriculture in Eastern New York. The observations of 1898 are in line with all previous records. In quantity and quality New York beets appear to compare very favorably with those produced in other parts of the world.

COMPOSITION OF SUGAR BEETS GROWN IN 1898.

		Sugar in beet.	Sugar in juice.	Purity of juice.
Total of season's results { 343 Samples	Lowest	7.4	7.8	64.1
	Highest	20.2	21.2	90.0
	Average	14.2	15.0	85.2

The yields reported from the plats grown by farmers in co-operation with the Station varied from 8,670 lbs. to 58,990 per acre, the lowest yield being on plats receiving no fertilizer and the highest occuring on muck land, the average being 26,720 lbs. In these experiments the average per ct. of sugar was 15.5 per ct., which is over 1 per ct. higher than the general average for 33 counties, which is probably due not so much to location as to better conditions of growth and culture.

The figures given as the cost of growing these beets are chiefly valuable as showing the distribution of time, the expensiveness of neglect in one or two cases and of a general unpreparedness for the work. Should the growing of sugar beets become generally established, experience and the possession of better machinery would certainly considerably reduce the labor cost of the crop, especially with large areas.

It is fair to remark, also, that if a careful record were kept of

the labor expended in growing other crops, long established, the relation of cost to production might in many cases appear to be unfavorable to profit. We are applying to the sugar beet crop a record and analysis of cost in a way not generally attempted with general farm crops, which is somewhat unfair in an effort to judge of relative profits.

It is somewhat doubtful whether widespread experiments on limited areas, such as have been conducted for two years, can be continued profitably. Such experiments will hardly furnish reliable evidence concerning anything more than the quantity and quality of beets produced, and with regard to these two points we are now warranted in reaching conclusions. The work of the experiment station in the future should be confined to a study of certain problems of production as affecting quality and yield.

For instance, we have been taught that farm manures should not be applied to land in the spring prior to growing a crop of sugar beets, and that the use of large quantities of nitrogenous fertilizers is antagonistic to high quality.

Experiments on the Station farm and on that of Mr. Dawley do not support these conclusions. On the Station farm, beets grown on land to which was applied in the spring 10 cords per acre of barn manure were as a whole richer than those with or without commercial fertilizers, were healthier and in appearance were a more satisfactory crop. Large additions of nitrogen as nitrate of soda and dried blood did not appear to depress the proportion of sugar. These observations should be continued in order to establish the facts, and other problems of equal interest wait for solution.

The difficult questions which confront the beet sugar industry in this country are now those of a commercial character which relate to production and manufacture. To be sure farmers need to be educated in methods, but nothing will accomplish this so effectually as actual experience in growing beets in a commercial way. Manufacturers will find, too, that the real conditions of their business are different from those previously displayed on paper. Moreover, the relations between the farmer and the manufacturing plant are likely to be for some time the occasion of wide differences of opinion before a generally recognized business basis is reached.

Tests of varieties from foreign sources.—In the spring of 1898 at the request of Mr. D. G. Fairchild, special agent for plant and seed introduction for the U. S. Department of Agriculture, Washington, D. C., the Station undertook to test a a large number of melons and a few other vegetables, seeds of which had been imported through Prof. N. E. Hansen who visited East Europe, Siberia and Northwest China in 1897 for the purpose of collecting for the Department seeds and plants which seemed likely to be valuable in the semi arid regions of this country.

In the collection of seeds which were sent to this Station there were about ninety varieties of Russian muskmelons and watermelons, besides a number of kinds from Asia. Seeds of pumpkin, sweet corn, turnip and six varieties of cabbage were also received.

Arrangements were made to test these vegetables at Geneva and to duplicate the tests on Long Island. The cabbage and turnip were tested under the direction of Mr. C. L. Allen of Floral Park to whom we are indebted for many courtesies. Mr. Allen is well known as an authority on the *Brassicas*. The other vegetables were tested at Southampton under the direction of Mr. F. L. Greene, a graduate of the Massachusetts Agricultural College.

In every instance the crops were grown on soil naturally well adapted to their culture and the ground was carefully prepared, fertilized sufficiently to provide for a vigorous growth and given good cultivation. At Geneva the melons were started on inverted sod under glass and not transferred to the field till warm weather was established. On Long Island, where the season is longer, the seeds were planted in the field.

As a result of the season's work it must be said that but one variety in the whole list proved to be really promising and that was one of the cabbages. Mr. Allen reports that it is a variety of the Flat Dutch or Drumhead type, producing a very deep and solid head, a strong grower and after a few generations grown in this country would probably develop a very useful variety, particularly for the South and West. The other cabbages were some of them mixed, others were inferior strains of varieties already known here and the rest were not at all promising. The turnip was an inferior type of ruta baga.

Of the Russian melons which were successfully fruited one

ranked good in quality, eleven ranked fair to good, fifteen were only fair, twenty-four were poor and thirteen ranked from poor to fair or good with different specimens. Twenty-four were selected as possibly worthy of further testing. Ten kinds of seed gave mixed varieties of melons. The record of the Asiatic melons was even more discouraging than that of the Russians. They seemed to be especially subject to disease and the fruit when any was obtained ranked far below that of American kinds which were grown beside them for comparison. The Russian melons also appeared to be more subject to disease than the American sorts. Notwithstanding several treatments with Bordeaux mixture the anthracnose did much damage and together with the bacterial disease injured many kinds so seriously as to prevent the development of perfect fruit.

Fertility of grapes.—It has been found that many varieties of cultivated grapes are self-sterile; others are imperfectly self-sterile, that is to say when cross pollination is prevented they form clusters which are more or less imperfect; others are fully self-fertile. The last class includes nearly all the varieties which have proved satisfactory in commercial vineyards.

Investigations concerning the self-sterility of grapes have been conducted at this Station since 1892 and in 1897 the tests were repeated with several varieties in two localities in the vineyard region of Western New York.

One hundred and sixty-nine cultivated varieties have been included in these tests together with a few vines representing uncultivated native species. Eleven species have been under investigation.

Different kinds of flowers are found with the grape, *Vitis*, but each vine normally bears only one kind. The so-called male vines produce no fruit for they bear staminate flowers only, having no pistils or, at most, rudimentary pistils. These flowers have long stamens. All fruitful vines bear perfect flowers, having both stamens and pistil. These may be separated according to the structure of their flowers into three classes, those with short, recurved stamens, those with long upright stamens and those with stamens intermediate between long and recurved.

Flowers with long stamens are structurally adapted to insure self-pollination. The short recurved stamens do not favor close pollination.

Forty-seven varieties having short stamens were tested for self-fertility. When cross-pollination was prevented only eight set any fruit, and none of these formed perfect clusters. In many cases varieties having long stamens were self-sterile, the pollen being self-impotent. Short stamens are, so far as known, a reliable indication of partial or complete self-sterility. It cannot be said that long stamens are a sure indication of self-fertility.

Lists of self-sterile, partly self-fertile and self-fertile varieties based on the experiments referred to are published in a bulletin. When self-sterile or partly self-fertile varieties are cultivated they should be mingled with other varieties so as to favor cross pollination.

Tables have been prepared from the records of the Station vineyards whereby the date of blooming of the different varieties may be compared. This will assist those who wish to grow any of the self-sterile varieties in deciding what varieties may be mingled with them to provide for cross pollination.

Ringing grap-vines.—Conclusions drawn from results of experiments are as follows :

Vines should be vigorous and not be ringed too severely.

A ringed vine cannot carry as large a crop of fruit to maturity as an ungirdled vine.

Vines grown on renewal system should have all arms ringed and all fruit back of the ring should be removed. Fruit on unringed arm is inferior, while fruit back of a girdle is worthless.

With many varieties, when properly done, ringing does not seriously injure the quality of the fruit.

Not all varieties should be ringed.

Too severe ringing will kill the vines.

With some varieties and in some seasons girdling will hasten time of ripening 8 or 10 days and in some cases increase size of bunch and berry at least a half.

DEPARTMENT OF BOTANY.

Spraying experiments on cucumbers.—During the season of 1898 co-operative spraying experiments on late cucumbers were conducted in four different localities on Long Island : Green Lawn, one and one-half acres ; Smithtown Branch, two acres ; Deer Park, two acres ; and Mattituck, two acres. Owing to lack of fertility in the soil, the experiment at Mattituck was a failure. At the other three places the sprayed fields remained practically free

from the downy mildew or "blight" and gave an average yield of 86,000 marketable cucumbers per acre, while unsprayed fields in the same localities and under approximately parallel conditions yielded on the average about 35,000 per acre.

From the results of experiments made during the past three seasons we are convinced that the spraying of late cucumbers on Long Island is a highly profitable practice.

DEPARTMENT OF ENTOMOLOGY.

The collection of insects.—This collection, which is steaily growing, has been reclassified under the direction of the Entomologist, by Miss Alice M. Beach whose work deserves special mention as it was exceptionally well done. The block system is used. Supplementary to this collection a collection of plants and portions of plants is being made showing the injury to the plants caused by noxious insects.

Experiments to determine the effects of hydrocyanic acid gas upon the eggs of insects.—These experiments have not been completed. A large number of eggs, especially of certain common species of plant lice, have been fumigated, however, the time of exposure to the gas varying from ten minutes to one hour. The results so far indicate that the eggs of such insects as plant lice can be destroyed by fumigation with hydrocyanic acid gas, a matter of importance to the nurserymen.

The grape-vine flea-beetle.—Investigations into the life history and habits of this insect have been begun with the result that new facts relating to its life history have been ascertained. Preparations have been made for more extended experiments another season than there was opportunity for during the past summer.

Spraying experiments with arsenite of lime against the canker worm.—These are a continuation of the experiments of last year. Excellent results were obtained with the arsenite of lime made after the Kedzie formula. The experiments were made in an apple orchard at Rushville owned by Mr. O. L. Jackson. Three applications of the poison were made with the result that the infested trees were practically freed from the canker worms.

The apple-tree tent-caterpillar.—The life history of this insect has been studied during the past season and observations made as to its natural enemies. Nearly eighty per ct. of a large number

of cocoons collected were parasitized. Six species of parasites were reared in the laboratory from these cocoons.

The raspberry saw-fly.—The life history of this insect has been studied and experiments made to ascertain a remedy. Good results were obtained with hellebore. Original observations have been made upon the various stages of the insect's life, especially the larva, pupa and the adult male.

The San José scale.—Extensive experiments against this insect have been begun. The experiments include tests with pure kerosene oil and kerosene oil mechanically mixed with water in the proportions of 20 per ct. and 40 per ct. oil, also whale oil soap solution and a solution of caustic potash at various strengths. In the experiments with kerosene oil, a large number of healthy nursery and orchard trees of various varieties have been sprayed to ascertain the effect of the kerosene oil upon healthy trees.

DEPARTMENT OF ANIMAL INDUSTRY.

The economy of using animal food for poultry.—A number of feeding experiments have shown almost invariably an advantage in the use of rations containing animal food over rations consisting entirely or largely of vegetable food. The data from some of the experiments made to determine the relative efficiency of vegetable and animal food have been published. The points brought out by these data are indicated in the following summary.

A ration in which about two-fifths of the protein was supplied by animal food was much more profitably fed to chicks than another ration supplying an equal amount of protein mostly from vegetable sources but supplemented by skim-milk curd.

When the two rations were fed to cockerels also, the results were favorable to the animal food, but the difference was not so pronounced as with the chicks.

Pullets fed the ration containing the large proportion or animal food attained ultimately somewhat the larger average size, but the chief advantage over those fed the contrasted ration was in the more rapid growth and earlier maturity.

With ducklings much the better results accompanied the feeding of a ration in which about half the protein was supplied by animal food. The growth was over three times as rapid as under another ration in which most of the protein was of vegetable origin with enough skim-milk curd added to supply about one-fourth of the total protein.

In the general vigor and health of the chicks there was some difference in favor of the animal food ration. This difference was very pronounced with the ducklings.

PRODUCTION OF FIELD CROPS.

The experiments on Long Island in the use of commercial fertilizers on potatoes have been continued with some enlargement. Three acres of land are now in use on each of four farms. A fertilizer experiment with onions was also carried on in 1898. Twelve acres of land on the Station farm are now devoted to a somewhat elaborate study of methods of maintaining fertility, and although two years' results are already in hand, nothing will be published for some time, perhaps not for several years.

BULLETINS PUBLISHED IN 1898.

The following is a list of the bulletins issued by the Station for the year 1898.

No. 143—April.—Cottonwood leaf beetle. Green arsenite. V. H. Lowe. Pages 24, plates 6.

No. 144—September.—A spraying mixture for cauliflower and cabbage worms. F. A. Sirrine. Pages 23, plates 6.

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